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(54) Conveyor or elevator for discrete materials.

(57) A conveyor or elevator comprising an endless flexible member having a plurality of plate-like members mounted thereon at spaced intervals and extending transversely to the longitudinal axis of the flexible member, the endless flexible member extending around a pair of spaced sprockets (5,8) at least one of which is driven, a casing (1) surrounding one of the sprockets (5) and a housing (2) surrounding the other sprocket (8), tubes (3) extending between the casing (1) and housing (2) through which the endless flexible member and plate-like members pass and hopper means (12) associated with the casing (1) for feeding material to be conveyed or elevated between successive plate-like members as they pass around the sprocket (5), wherein the hopper means (12) is connected to the casing (1) by hinge means (13) whereby it can be hinged from an in-use position in which it is operatively connected with the casing (1) and an out-of-use position in which access is provided to the interior of the casing (1).

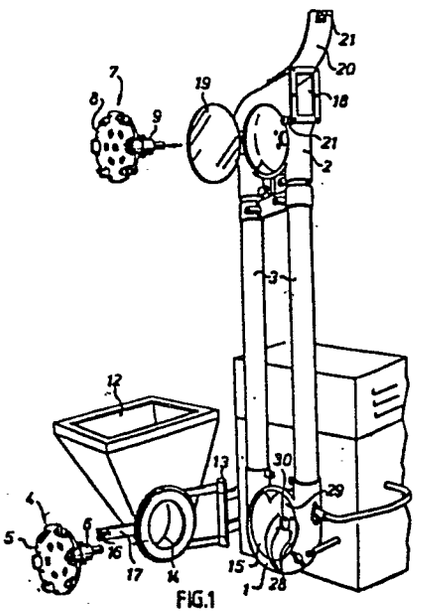

FIG.1

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CONVEYOR OR ELEVATOR FOR DISCRETE MATERIALS

This invention relates to conveyors or elevators for discrete materials, e.g., granular or powder materials.

A known conveyor or elevator for discrete materials comprises an endless flexible member having a plurality of plate-like members mounted substantially centrally thereon at spaced intervals and extending transversely to the longitudinal axis of the flexible member, the endless flexible member extending around a pair of spaced pulleys or sprockets (hereinafter termed "sprockets") at least one of which is driven, a casing surrounding one of the sprockets, a housing surrounding the other of the sprockets, and at least one tube extending between the casing and the housing through which the endless flexible member and the plate-like members pass, the material to be conveyed or elevated being fed to the spaces between successive plate-like members as the plate-like members pass around said one sprocket and the material being discharged from between the plate-like members by centrifugal action as the plate-like members pass around said other sprocket. Generally, in such a conveyor or elevator, the endless flexible member

is driven at a speed of from 300 to 1200 feet per minute, preferably 600 to 1200 feet per minute, and the plate-like members are a clearance fit within the or each said tube. Such a conveyor or elevator is hereinafter referred to as "a conveyor or elevator of the kind described".

Conveyors or elevators of the kind described have proved to be extremely efficient for conveying or elevating a wide variety of discrete materials such as pharmaceuticals and chemicals in powder form, detergent powders, grain, and the like due, it is believed, to the fact that such materials readily become entrained in the current of air which is created by the passage of the plate-like members through said tube or tubes. Problems do arise, however, when a conveyor or elevator of the kind described requires to be cleaned, adjusted or repaired. Cleaning can be effected by feeding the first of a new batch of material into the conveyor or elevator to purge the conveyor or elevator of the remains of a previous batch of material, by feeding a completely different material such as wheat, which is particularly effective because of its clean grains, grain size, hardness and toughness, into the conveyor or elevator to purge it of the remains of a previous batch of material, or by blocking-off the discharge outlet of the conveyor or elevator and feeding warm water, with detergent or other cleaning agent, into the conveyor or elevator whilst it is

running to wash away the remains of a previous batch of material. Whilst one or more of these different methods of cleaning the conveyor or elevator works reasonably well with most materials, there are some materials which cannot be satisfactorily cleared from the conveyor or elevator by any of these methods. Moreover, repair and maintenance work, particularly to the sprockets, sprocket shafts and shaft bearing assemblies, tends to be neglected because in order to gain access thereto it is necessary to disassemble the conveyor or elevator and remove the said casing and the said housing and this is a somewhat tedious and time-consuming process, particularly since the casing surrounding said one sprocket has attached thereto a feed hopper for feeding material into the conveyor or elevator.

The present invention has as its object to overcome or mitigate some or all of the aforesaid problems.

The present invention provides a conveyor or elevator of the kind described wherein said casing has a feed hopper hingedly connected thereto which can be hinged from an in-use position to an out-of-use position to provide access to the interior of the casing.

Preferably said housing comprises at least one cover plate which can be opened or removed to provide access to the interior of the housing. Said at least one cover plate is preferably hingedly connected to the housing so that it can be hinged from a closed to an open position to provide access to the interior of the housing.

Suitable releasable means may be provided for retaining the feed hopper in its in-use position. Such releasable means may comprise, for example, suitable screw or catch means.

Likewise suitable releasable means may be provided for retaining said at least one cover plate in closed or in assembled relation to said housing. Again such releasable means may comprise suitable screw or catch means.

Providing easy access to the interiors of the casing and the housing in accordance with the present invention greatly facilitates cleaning of the conveyor or elevator since cleaning can be effected by blasting the interiors of the casing and the housing with a jet of air or by brushing the interiors of the casing and the housing and removing dislodged material by suction, e.g., using a vacuum cleaner.

According to a further feature of the present invention each of said sprockets and its associated sprocket shaft, shaft bearing assembly and shaft seal are formed as a removable sub-assembly which can be readily removed from said casing or said housing as a unit.

By forming each of said sprockets and its associated sprocket shaft, shaft bearing assembly and shaft seal as a removable sub-assembly and providing easy access to the

interiors of the casing and the housing, repair and maintenance work is greatly facilitated since each of the sub-assemblies can readily be removed and taken to a workbench or the like for repair or maintenance work to be carried out thereon. Moreover, since each sub-assembly is a complete unit it provides the means to test the sprocket shaft and bearing assembly on a work-bench away from the conveyor or elevator.

A further problem which arises with conveyors or elevators of the kind described is that of ensuring that the endless flexible member is maintained at the correct tension. Due to wear and other causes the endless flexible member tends, in time, to slacken off and lose tension. Correct tensioning of the endless flexible member is necessary if the conveyor or elevator is to operate at optimum efficiency but tends to be neglected because it is such a tedious process to disassemble the conveyor or elevator to the stage where the tension of the endless flexible member can be tested and, if necessary, adjusted. Moreover, adjustment of the endless flexible member requires the exercise of a certain amount of judgement on the part of the person who is effecting the adjustment with the result that the endless flexible member is not always correctly tensioned.

To overcome this further problem the present invention provides a conveyor or elevator of the kind described having means for sensing whether or not the endless

flexible member is at the correct tension.

When the endless flexible member is correctly tensioned it follows closely the profiles of the said sprockets and extends between the sprockets in substantially straight lines tangential to the sprockets. As the endless flexible member loses tension due to wear, stretching of the endless flexible member or other causes, it tends to bow out away from the sprockets before entering said tubes and assuming its straight line run between the sprockets. Said sensing means is adapted to sense the said bowing out of the endless flexible member away from the sprockets. To this end the sensing means may be mounted in said casing or in said housing adjacent a said sprocket, e.g., substantially in the region where the endless flexible member leaves the sprocket and begins its run to the other of said sprockets.

The sensing means is preferably an electrical sensing means which will provide an electrical signal either when the endless flexible member is correctly tensioned or when it is incorrectly tensioned. Such electrical signal, or the lack thereof, may be used to actuate a suitable warning device or devices, e.g., a visual indicator such as a warning light and/or an audible indicator such as an audible buzzer or other alarm.

Said sensing means and warning device or devices

may be adapted to function and monitor the tension of the endless flexible member whenever the conveyor or elevator is in use or may be incorporated in a special test circuit which is only energized, e.g., as by means of a push-button switch, when it is required to check whether or not the endless flexible member requires adjustment.

As well as sensing when the endless flexible member is incorrectly tensioned and providing an indication thereof, the sensing means and warning device or devices also facilitates the adjustment of the endless flexible member since the tension of the endless flexible member can be adjusted until the sensing means and warning device or devices indicates that the endless flexible member is no longer incorrectly tensioned.

Alternatively, or in addition, the electrical signal from the sensing means, or the lack thereof, may be used to actuate a servomotor or other prime mover for adjusting the tension of the endless flexible member. Thus, for example, when the sensing means senses that the endless flexible member is incorrectly tensioned said servomotor or other prime mover may be actuated to adjust an adjustable one of said sprockets until such time as the sensing means senses that the correct tension has been restored to the endless flexible member.

The invention will be more particularly described with reference to the accompanying diagrammatic drawings,

in which:-

Fig. 1 is a partially exploded perspective view of a conveyor or elevator according to the present invention,

Fig. 2 is a fragmentary view showing a correctly tensioned endless flexible member extending around a pair of spaced sprockets, and

Fig. 3 is a view similar to Fig. 2 but showing an incorrectly tensioned endless flexible member.

Referring to the drawings it will be seen that the conveyor or elevator illustrated comprises a casing 1 and a housing 2 which are connected together by substantially parallel tubes 3. Mounted within the casing 1 is a removable sub-assembly 4 comprising a sprocket 5, sprocket shaft 6, bearing assembly (not shown) and shaft seal (not shown) whilst mounted within the housing 2 is a similar sub-assembly 7 comprising a sprocket 8, sprocket shaft 9, bearing assembly (not shown) and shaft seal (not shown). Extending around the sprockets 5 and 8 and through the tubes 3 is an endless flexible member 10 having a plurality of plate-like members 11 mounted substantially centrally thereon at spaced intervals and extending transversely to the longitudinal axis of the endless flexible member.

The casing 1 has a feed hopper 12 connected thereto by means of a hinge 13, the feed hopper 12 being shown in its out-of-use position in Fig. 1. When in its in-use position an outlet opening 14 at the bottom of the feed

hopper 12 is aligned with an inlet opening 15 in the casing 1. The feed hopper 12 is securable in its in-use position by means of a screw-threaded stud (not shown) on the casing 1 which engages an open-ended slot 16 in an arm 17 attached to the feed hopper 12, a butterfly or other suitable nut (not shown) being threaded onto the stud. When the hopper 12 is in its out-of-use position indicated access can readily be had to the interior of the casing 1 either for cleaning the interior of the casing or for inspection, maintenance, repair or removal of the sub-assembly 4.

The housing 2 has a discharge opening 18 therein through which discrete material which has been conveyed or elevated is discharged by centrifugal action. The housing 2 comprises a hinged front cover plate 19 and a hinged top cover plate 20, both of which can be hinged open as shown in Fig. 1 to allow ready access to the interior of the housing 2. The cover plates 19 and 20 are provided with catches 21 or other suitable releasable means for retaining them in their closed position.

Mounted in the casing 1 adjacent the sprocket 5 is an electrical sensing means 22 for sensing whether or not the endless flexible member 10 is correctly tensioned. When the endless flexible member 10 is correctly tensioned then as shown in Fig. 2 it follows closely the profile of the sprockets 5 and 8 and extends

in substantially straight lines between the sprockets. As the endless flexible member 10 loses tension so it tends to bow out away from the sprockets 5 and 8 as shown in Fig. 3. The sensing means 22 senses this bowing out of the endless flexible member and provides an electrical signal which is used either to actuate an alarm or indicator device, e.g., a warning lamp, or to actuate a servomotor or other prime mover for restoring tension in the endless flexible member 10.

Claims:

1. A conveyor or elevator comprising an endless flexible member having a plurality of plate-like members mounted substantially centrally thereon at spaced intervals and extending transversely to the longitudinal axis of the flexible member, the endless flexible member extending around a pair of spaced sprockets at least one of which is driven, a casing surrounding one of the sprockets, a housing surrounding the other of the sprockets, at least one tube extending between the casing and the housing through which the endless flexible member and the plate-like members pass, hopper means associated with said casing for feeding material to be conveyed or elevated to the spaces between successive plate-like members as the plate-like members pass around said one sprocket and an outlet from said housing through which said material will be discharged by centrifugal action as the plate-like members pass around said other sprocket, said hopper means being hingedly mounted whereby it can be hinged from an in-use position in which it is operatively connected with said casing and an out-of-use position in which access is provided to the interior of the casing.

2. A conveyor or elevator according to claim 1, wherein said hopper means is hingedly connected to said casing and comprises an outlet opening at a bottom portion thereof which cooperates with an inlet opening

of said casing when the hopper means is in its in-use position.

3. A conveyor or elevator according to claim 1 or 2, wherein releasable means is provided for releasably retaining the hopper means in its in-use position.

4. A conveyor or elevator according to claim 3, wherein said releasable retaining means comprises screw or catch means.

5. A conveyor or elevator according to any one of the preceding claims, wherein said housing comprises at least one cover plate which can be removed or opened to provide access to the interior of the housing.

6. A conveyor or elevator according to claim 5, wherein said cover plate is hingedly connected to the housing whereby it can be hinged from a closed to an open position to provide access to the interior of the housing.

7. A conveyor or elevator according to claim 6, wherein releasable retaining means is provided for releasably retaining said cover plate in its closed position.

8. A conveyor or elevator according to any one of the preceding claims, wherein each of said sprockets has associated therewith a sprocket shaft, shaft bearing assembly and shaft seal and wherein each sprocket and its associated sprocket shaft, shaft bearing assembly and shaft seal comprises a removable sub-assembly which can be removed from said casing or said housing as a unit.

9. A conveyor or elevator according to any one of the preceding claims, comprising means for sensing whether or not the endless flexible member is at the correct tension.

10. A conveyor or elevator according to claim 9, wherein said sensing means is adapted to sense any bowing of the endless flexible member away from a said sprocket.

11. A conveyor or elevator according to claim 10, wherein said sensing means is mounted in said casing or in said housing adjacent a said sprocket.

12. A conveyor or elevator according to claim 9, 10 or 11, wherein said sensing means is an electrical sensing means which will provide an electrical signal either when the endless flexible member is correctly tensioned or when it is incorrectly tensioned.

13. A conveyor or elevator according to claim 12, wherein said electrical signal, or the lack thereof, is used to actuate a warning device or devices.

14. A conveyor or elevator according to claim 13, wherein said warning device comprises a warning light and/or an audible alarm.

15. A conveyor or elevator according to claim 12, 13 or 14, wherein at least one of said sprockets is adjustably mounted and wherein said electrical signal, or lack thereof, is used to actuate means for adjusting said at least one sprocket to adjust the tension of the endless flexible member.

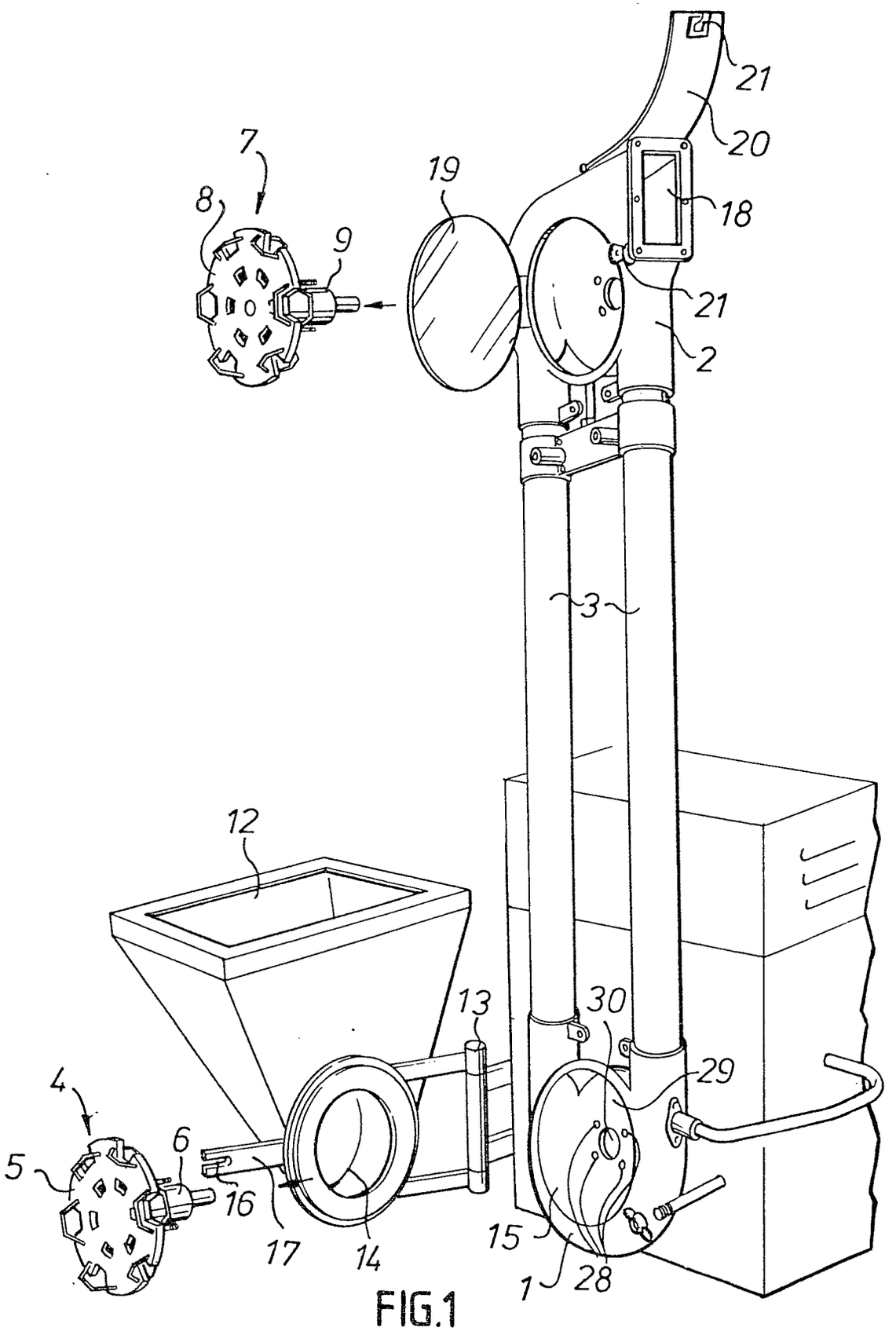

FIG.1

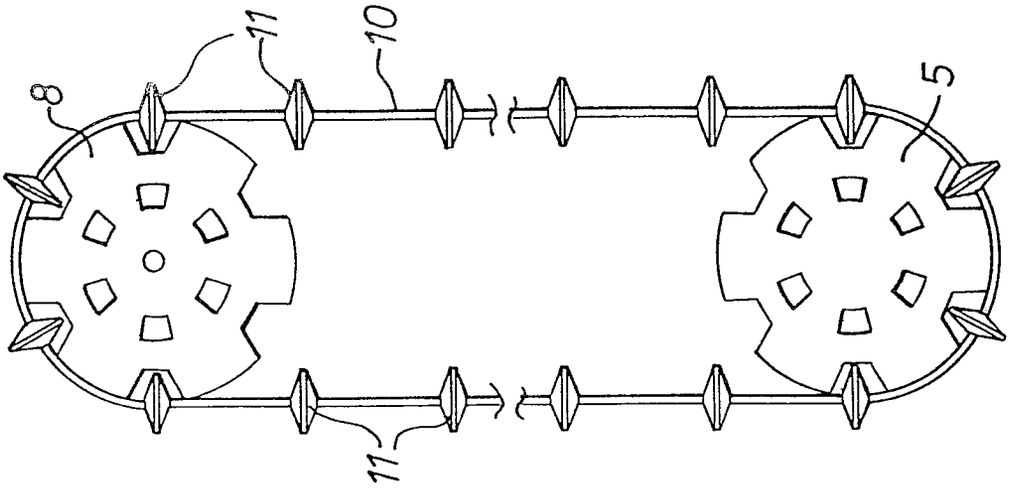

FIG. 2

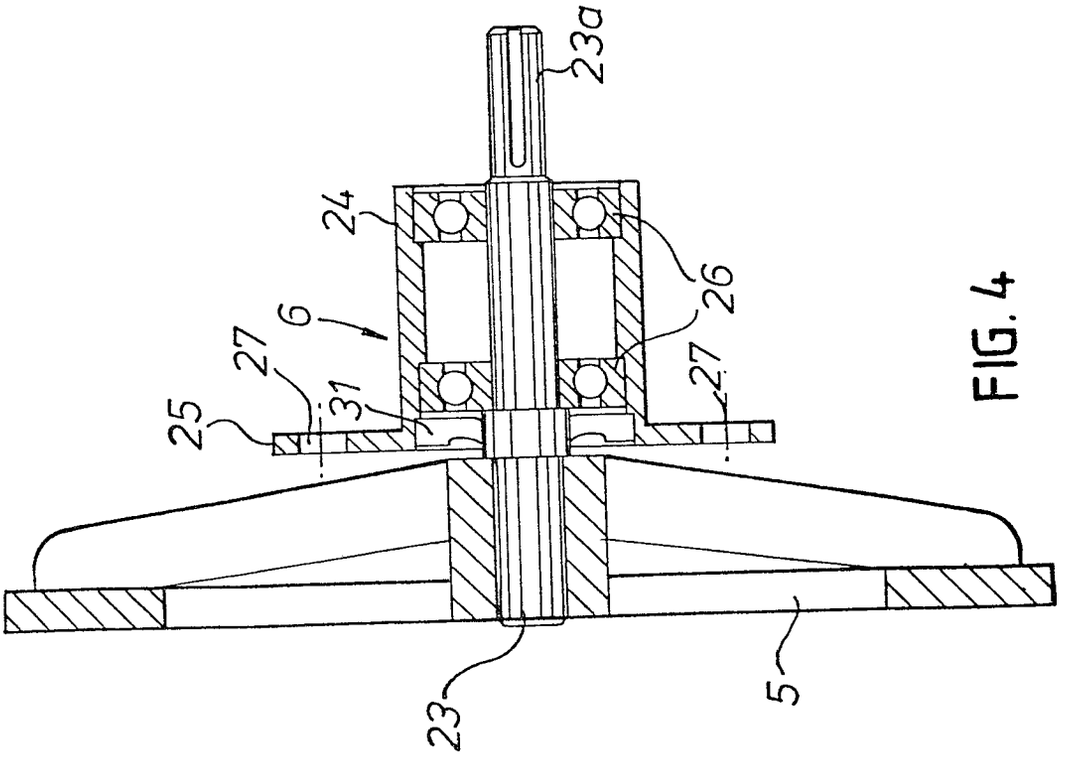

FIG. 4

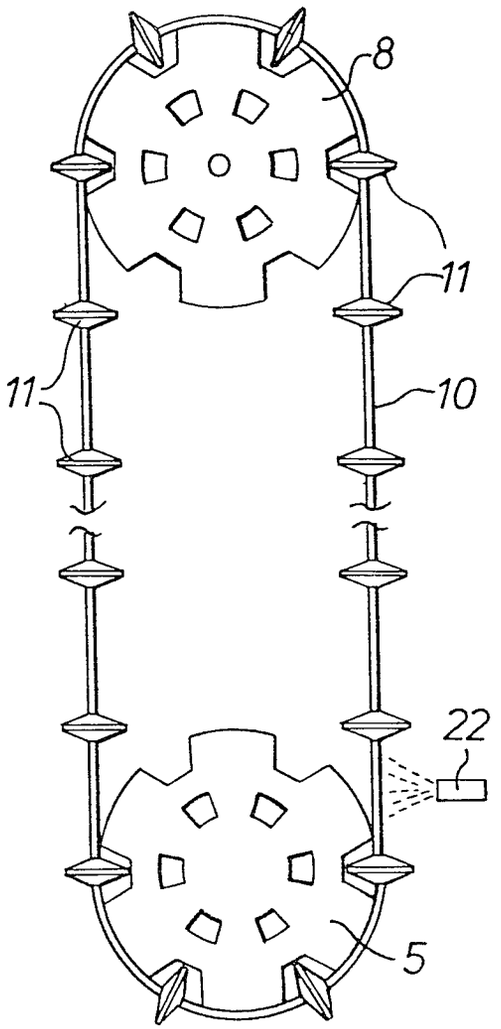

FIG. 3

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EUROPEAN SEARCH REPORT

Application number
EP 80 30 2267.2

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 2 643 760 (BORTNER) * column 3, line 71 to column 4, line 8 *	1, 4-7
	US - A - 2 817 430 (HAPMAN) * column 4, lines 69 to 74; fig. 2 *	5,7
	US - A - 3 549 003 (JACOBSON) * abstract *	5
	US - A - 3 372 791 (KENNEDY) * column 2, lines 24 to 26 *	5
	US - A - 2 887 190 (ROLOSON) column 2, lines 27 to 35 *	5
	DE - U - 1 898 385 (FARWICK) * page 1, line 1 to page 2, line 15 *	5
	GB - A - 1 447 169 (PRODUCTION MACHINERY CO.) * page 3, lines 39 to 41 *	8
	GB - A - 1 505 064 (ROWLANDS ENGINEERS LTD.) * page 3, lines 41 to 57 *	9,12
A	FR - A - 1 342 683 (WALKER)	
A	US - A - 4 071 136 (JONES)	

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CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 65 G 19/14
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TECHNICAL FIELDS SEARCHED (Int.Cl.³)

B 65 G 17/00
B 65 G 19/00
B 65 G 21/00
B 65 G 23/00
B 65 G 41/00
B 65 G 43/00
B 65 G 45/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	30-09-1980	SIMON

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 80 30 2267.2

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	US - A - 3 905 473 (JONES et al.) ----		TECHNICAL FIELDS SEARCHED (Int. Cl.³)